PRESIDENTIAL ADDRESS

OUR MOCCASINS

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It is not without some humility that I appear before you this morning; for as I look over the list of Past Presidents, I find that I am the first engineer in the History of the South Dakota Academy of Science to be elected its President. I believe that this in itself is significant because it indicates an interest on the part of our Academy to bring together the various disciplines that constitute the technology of this modern world.

By this, I am not implying that each of us should become experts in a field foreign to his immediate interests—far from it—for it has been estimated by science writer Fredric C. Appel that man's total knowledge doubled between 1775 and 1900; doubled again between 1900 and 1950, again between 1950 and 1958, and is thought to be doubling every five years. In other words, by next year, the total body of knowledge of man will be 32 times that of our alchemist forefathers. Bringing it closer to home, the total knowledge of man today is nearly eight times what it was when many of us launched our technological careers during and toward the end of World War II. Thus, it is highly improbable that any individual can become proficient in all the fields of science and engineering. The indications are to the contrary, that is, the disciplines will become even more diverse.

Further evidence of the progress of man is illustrated by a story told by Dr. Donald A. Dahlstrom in his presidential address to the American Institute of Chemical Engineers. The story concerns a young man attending an Episcopal school in Oregon in the 1880's. One day he went to the president of the college to ask if he could get some funds or some sort of facilities to do research work (a not unheard of problem even in today's expanding technology). The president said he would have to ask the Bishop when he came. Fortunately, a few months later, the Bishop did come around. And the young man asked the Bishop if he could do research. The Bishop looked at him and he said, "Son, we know everything there is to know. We do not need to do any more research; therefore, I cannot recommend such an expenditure." The young man was pretty disheartened, and the Bishop furthermore went on and said, "What would you do research on if you were given facilities?" The man looked at the Bishop and said, "Well, I believe that some day man will fly like the birds." The Bishop looked at him and said, "Young man, for that I think your soul will roast in Hell." The Bishop was the father of Wilbur and Orville Wright.

Fortunately, though the attitude of Bishop Wright may have been universal during the latter part of the nineteenth century, it did not prevail for long and we have the situation arising that the solution to a problem begot one or more additional problems which required study. Thus, with the increase in knowledge and the inherent increase in the number of problems came an increase in demand for scientists and engineers. Where at the turn of the century, we had relatively few individuals who were classified as technical experts, today we have a much larger number with predictions that we will need even more.

The National Science Foundation has estimated that, in order to maintain The National rate of growth, the United States will need 1,375,000 engineers by 1970—718,000 more than were available in 1960. But all of the colleges and universities in the United States are not expected to graduate more than 450,000 during the 1960 decade. This leaves a deficit of over 250,000—nearly 35% of the total additional required. A similar shortage has been estimated to exist in the various fields of Science.

In this manner, we have formulated our problem. We are faced with an expotential increase in knowledge with a tremendous shortage in educated personnel to meet the challenge of obtaining and applying this knowledge to the benefit of mankind. What is the solution? I am sure that wiser men than I have wrestled with this problem and have not managed to arrive at a simple solution.

With such a glowing future facing the youth of our nation in careers in science and engineering, why are they not rallying to the call? Why was there a decrease in enrollment in engineering schools between 1958 and 1964—between Sputnik and Gemini?

I am afraid that part of the answer is inherent in our quasi-socialistic society where it is possible to enjoy a maximum of comfort and luxury by expending a minimum of effort—and letting our rich Uncle pick up the tab. So that the high school and college students who are here today won't think that I am pointing an accusing finger at them, let me hasten to add that this creeping socialism has become increasingly prevalent each year since 1932. I should also like to admonish them that it is their duty, as well as privilege along with the older generation, to search diligently for methods to combat this condition which is threatening to throttle our society.

But this alone cannot be the sole cause for the apparent decrease in interest of our youth in Science and Engineering. It was about ten years ago that the Russians launched the first Sputnik—

and we literally hit the panic button. We subjected our entire educational system to an inquisition which made it appear to be a product of the Dark Ages. Everything was right about the Russian System, and no one could find a good word to say about our system of mass education. The revisionists started with pushing various mathematics and scientific courses from the colleges to the high schools and from the high schools to the grade schools. We look back with pride on the "upgrading" that has occurred in our school system; but, I wonder if we have stopped to analyze the effect on the person most immediately concerned, namely, the high school student! Have we ever stopped to examine the rat race to which we subject some of our more promising high school students? Dr. L. Carroll King, Professor of Chemistry at Northwestern University, did and wrote about it in the February 20, 1967, issue of the *Chemical and Engineering News*. He relates the story of a typical day of Mr. Good Student who attends a typical suburban high school—and I am certain that most of you recognize this day. The student gets out of bed at 7:00 in the morning, grabs something to eat, and is off to school to begin classes at 8:00. During the next seven and a half hours, he attends at least four hours of subject matter classes, attends a gym class, and one other nonacademic class, such as driver education. He eats lunch and, if he is lucky, has one study period before he returns home at 4:30.

By 6:00 in the evening he has just enough energy to make it to the dinner table. At 7:00, it's time for study and homework. For the good student, this lasts three or four hours, if all goes well. By 11 o'clock or midnight, he can go to bed, his 17-hour day complete. Included in this schedule, of course, is the participation in the various extra-curricular activities in which Mr. Good Student is expected and encouraged to participate.

I believe that we can agree with Dr. King that after 3 to 4 years of this activity in high school (and, maybe, to a lesser extent in the Junior High and Grade schools) that Mr. Good Student is no longer that. He is a tired, discouraged, old man. By the time he has completed the secondary school, we have asked him to do too much, too fast, too soon, and we have asked him to keep at it too long. In effect, we have asked a boy to do a man's work.

When he is asked to face the same type of rigorous training—but to an expanded extent—he says "nuts"—and quits. Thus, an able body is lost to our ever expanding needs of science and engineering.

To alleviate the situation, Dr. King has suggested the following:

1. "Revive the concept that the function of our schools is to train and educate students. This is the only legitimate function of the school system and the sole reason for its existence.

2. "Revive the concept that the student has a right to receive individual attention and consideration, and a right to proceed at his own rate.
3. "Abandon the notion that the scholarly activity of teachers is responsible for the troubles of students. Even if they don't participate in research, students benefit when they associate with teachers who are active in research."

To most of Dr. King's suggestions, I can add my hearty endorsement; however, we must be careful that we do not permit the pendulum to swing too far in the other direction. Many of the most useful ideas that I gleaned from my high school education came from participation in activities other than formal course work.

In addition to the suggestions of Dr. King, there are other contributions which we, as educators, scientists, and engineers, can make to alleviate this pronounced shortage. One of the biggest contributions is to be as inspirational in our teaching as we possibly can. Nothing is of vaster significance than motivation. If we in our teaching are lackadaisical and uninspiring, if we treat our profession and our students as necessary evils, we are going to lose many prospective scientists and engineers. The converse is also true—the educator who can motivate his students does much to perpetuate his field of science and engineering.

It is also necessary that part of the hero worship which is directed toward the various fields of entertainment be focused on the activities of the scientist and engineer. If we are to persist in extra-curricular activities in our high schools, the school administrators and parents should be shown that the various forms of scientific activities such as the Junior Academy, Science Fairs, Saturday Seminars, and other such activities should be given equal billing, both financially and with moral support, with athletic and other such endeavors.

We have thus seen some general solutions to this acute problem of shortage of scientists and engineers. Now what can we as an academy do to relieve this condition?

First, those of us in the colleges and universities should do everything we can to support the secondary school instructor—and vice versa. I believe that the Visiting Scientist Program which was co-sponsored by the Academy and the National Science Foundation was working toward this end. We should make every attempt to obtain either reinstatement of the program or propose an acceptable substitute. Meantime, it behooves the members of the academy to continue the visitations if asked and if they possibly can.

Second, those of us in the academic environment must continually strive to become even more inspirational and motivating.

For several years, the National Association of Biology teachers has recognized a high school instructor for outstanding teaching. I wonder if the academy should adopt a similar program.

Third, the Academy should make it known to the governor that the members of the Academy would welcome the opportunity to offer their services as scientific advisors to the State Government. This would indicate to the youth that the technical personnel within the state is interested not only in the advancement of technology but also the application of it for the improvement of society through government. In a real sense, we can practice the admonition stated by the late President Kennedy in his inaugural address when he said, "Ask not what my Country can do for me, but what can I do for my Country."

Finally, and I believe most significant, we must continue to be the melting pot for the various technological disciplines. An old Indian prayer states "Great Spirit, grant that I may not criticize my neighbor until I have walked a mile in his moccasins." May the Great Spirit enable us to walk a mile in our fellow academy members' moccasins so that we may more fully understand and appreciate him and his work.